Interaction of a Fungus Gnat, Bradysia sp. (Sciaridae) with Fusarium spp. on Alfalfa and Red Clover

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The fungus gnat, *Bradysia* sp. (*Sciaridae*), is a minor greenhouse pest, and larval feeding causes damage of economic importance both in the greenhouse (1, 4) and in the field (2, 3). The likelihood that such feeding might predispose plants to attack by root pathogens has been mentioned (1), but no report was found that demonstrated the involvement of these insects in disease development. A large population of *Bradysia* sp. gnats occurred during legume-virus- and root-disease experiments in the greenhouse. Their presence prompted the investigation of larval feeding damage, particularly as it might affect the development of root diseases in alfalfa and red clover.

Trifolium pratense L. 'Pennscott' and *Medicago sativa* L. 'DuPuits' were grown in a lighted chamber at 22 ± 2 C. Seedlings, approximately 8 days old at inoculation or at the start of larval feeding, were grown either in autoclaved soil in glass bottles (35 ml volume) or in nutrient solution in plastic sacs (Dispo Growth Sacs). Autoclaved sand was used to fill around seedlings above the soil.

Larvae of the fungus gnat, *Bradysia* sp. (*Sciaridae*), were collected from beneath pots and flats in the greenhouse. Collections varied as to instar and feeding activity, and some were held for short periods at 4 C prior to use. Larvae were collected and transferred manually with a wet, camel's hair brush.

Feeding injury tests were done with plants grown in plastic growth sacs and in soil. Larvae were placed in the root area of plants in the plastic growth sacs, and on the surface of the sand in the glass bottles. Larvae, 0.5-3.3/plant, were allowed to feed at will throughout the injury tests.

Larvae feeding on roots of alfalfa and red clover in the plastic sacs killed 90% of the alfalfa seedlings in two tests, and 80% of the red clover seedlings in three tests. Larvae introduced in the root area below the fold in the wick often ate through the paper fold and fed on the stem portion above, and occasionally fed on leaf tissue. Main roots were often severed in less than 1 hr of feeding time, and at concentrations of less than one larva/plant. Larval feeding on alfalfa roots in soil killed more than 90% of the plants in two experiments. When feeding occurred at the soil line, the plants fell over and appeared as if damped-off.

Experiments to determine if larval feeding predisposed plants to invasion by *Fusarium* spp. were done in soil. In order to prevent death of the plants from feeding injury, seedlings were exposed to larval feeding for only a short time. This was accomplished by enclosing seedlings and larvae in a petri dish on moist filter paper and transferring slightly injured seedlings hourly to another dish until a sufficient number of such seedlings was obtained. One insect-injured seedling and one uninjured seedling, which was not exposed to the insects, were planted in each container.

Fusarium oxysporum Schlect. emend. Snyd. & Hans. f. sp. *medicaginis* was used in wilt disease tests with alfalfa, and *F. roseum* Link. emend. Snyd. & Hans. in root rot tests with red clover. Each fungus was grown in liquid culture in Richard's medium for 9-13 days. Mycelia and spores were filtered from the medium, washed, weighed, and suspended in water. Approximately 53 mg (wet wt.) of fungus suspended in 10 ml of distilled water were added to each growth container per inoculation; control plants received only the distilled water. Dead plants were examined to ensure that damping-off had not occurred.

Results from three disease-predisposition trials with red clover and *F. roseum* and two trials with alfalfa and *F. oxysporum* f. sp. *medicaginis* are summarized in Table 1. In all trials, plants injured by larvae prior to inoculation with *Fusarium* died at a much higher rate than did uninjured plants. The relatively low mortality of uninjured and insect-injured plants in the absence of a *Fusarium* inoculation (Table 1) indicates that contaminant organisms probably present on the larvae did not appreciably influence the results.

Fungus gnats are ubiquitous in greenhouse environments and are generally regarded as innoxious and ignored by most researchers. These findings show that larvae of this *Bradysia* sp. are not innoxious and can kill seedlings directly, as well as predispose plants to fungal attack. Fungus gnats should be controlled prior to and during root disease studies in the greenhouse. Control of these insects without the use of soil insecticides is difficult. However, in preliminary tests resin

TABLE 1. Interaction of feeding injury by fungus gnat larvae with *Fusarium* root disease in causing the death of red clover and alfalfa seedlings

Host	Pathogen	No. of dead plants[a]	
		No insect injury	Insect injury
Red clover	None	0	2
	Fusarium roseum	6	34
Alfalfa	None	0	0
	F. oxysporum f. sp. *medicaginis*	3	20

[a] Each value is the total from three experiments involving 36 red clover plants/treatment, or two experiments involving 28 alfalfa plants/treatment. Dead plants were recorded after 23, 32, and 54 days in the red clover tests, and after 21 and 33 days in the alfalfa tests.

strips containing dichlorvos (2,2-dichlorovinyl dimethyl phosphate) greatly reduced the number of adult flies, and appeared promising.

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